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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/976,927	10/11/2001	G. Ramanath	020752-000111US	2055

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EXAMINER

KIELIN, ERIK J

ART UNIT	PAPER NUMBER
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2813

DATE MAILED: 07/22/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Applicati n No.

09/976,927

Applicant(s)

RAMANATH ET AL.

Examiner

Erik Kielin

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 21 June 2002.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 12-23 is/are pending in the application.
- 4a) Of the above claim(s) 14, 16, 20 and 22 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 12, 13, 15, 17-19, 21 and 23 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 11 October 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____. 6) ☐ Other: _____

DETAILED ACTION

Election/Restrictions

1. Applicant's election without traverse of the invention of Group II, claims 12-23, in Paper No. 5 is acknowledged. Cancellation of claims 1-11 is acknowledged.

2. Applicant's election of species II-B, claims 15, 17, 21, and 23, in Paper No. 5 is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)).

Claims 14, 16, 20, and 22 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected species, there being no allowable generic or linking claim.

The generic claims are 12, 13, 18, and 19. Accordingly, claims 12, 13, 15, 17-19, 21, and 23 are active.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 12, 13, 15 and 18, 19, 21 are rejected under 35 U.S.C. 102(b) as being anticipated by US 5,079,600 (Schnur et al.).

Regarding claims 12 and 18, **Schnur** discloses an integrated circuit (Abstract) comprising a silicon substrate (Fig. 1A; col. 10, lines 28-29), a diffusion barrier layer (Fig. 1A, called “thin film”), and a metal (Fig. 3A; called “**metal**” and/or “**catalyst**” noting that the catalyst is also a metal --particularly palladium/tin, Pd/Sn) deposited on the diffusion barrier layer, wherein the diffusion barrier layer is covalently attached to the silicon substrate, and wherein the diffusion barrier is a self-assembled monolayer (col. 10, lines 42-47). (See also the sections entitled “EXAMPLE 1” col. 11, lines 24-58 wherein the barrier layer is formed from covalently bonded “octenyldimethylchlorosilane. See also “EXAMPLE 3,” “EXAMPLE 5” and “EXAMPLE 28” col. 21.) It is seen to be inherent that the “thin film” is a diffusion barrier, because it is the same thin film as disclosed and claimed by Applicant, and because the “metal” is on the “thin film” and is not shown in **Schnur** to diffuse through it, thereby meeting Applicant’s definition of “diffusion barrier.”

Regarding claims 13 and 18, the self-assembled monolayer comprises subunits of the claimed structure wherein (1) R^2 is alkyl group (in “EXAMPLE 1”) because octenyldimethyl is an alkyl group or, alternatively, a heteroaryl group (in “EXAMPLE 28”) because pyridyl (from “pyridine”) is a heteroaryl group, and wherein (2) the silicon atom is bonded to three oxygen atoms which are, in turn, presumably bonded near the substrate surface because at least in “EXAMPLE 28” *trichloro*-(4-pyridyl)-ethyl-silane is used and each of the chlorine atoms is chemically reactive and therefore replaced by Si-O bonds to the surface to “anchor” the molecule to the surface of the Si substrate (col. 10, lines 37-40). (For explicit verification of this inherency, see US 4,996,075 [**Ogawa et al.**] Fig. 1(b) and associated text at col. 2, lines 37-60.)

Regarding claims 15 and 21, see “EXAMPLE 28” noting that trichloro-(4-pyridyl)-ethylsilane meets the structure limitations of the R^2 group wherein “ethyl” is the $(CH_2)_n$ group with $n=2$, “pyridyl” is the six-atom aromatic, nitrogen-containing group, and R^3 and R^4 are both hydrogen. Note that since the attachment of the ethyl group to the pyridyl group is at the “4” position (rather than the “2” position), the molecular structure limitation claims 17 and 23 are *not* met.

5. Claims 12, 13, 15, 17, and 18, 19, 21, and 23 are rejected under 35 U.S.C. 102(b) as being anticipated by US 5,389,496 (**Calvert et al.**).

Regarding claims 12 and 18, **Calvert** discloses an integrated circuit (sentence bridging cols. 10-11) comprising a silicon substrate (col. 10, lines 52-53), a diffusion barrier layer (called “chemical groups” or “catalyst ligating groups”), and a metal (col. 4, lines 58-61) deposited on the diffusion barrier layer, wherein the diffusion barrier layer is covalently attached to the silicon substrate (col. 3, 56 to col. 4, line 8), and wherein the diffusion barrier is a self-assembled monolayer.

Note that although no drawings are provided, the subject matter is the virtually exactly same as that in the **Schnur** reference above **which is a parent patent** of the **Calvert** patent and is therefore incorporated by reference in its entirety including the Figs. Accordingly, it is seen to be inherent that the covalently bonded “chemical groups” or “catalyst ligating groups” of **Calvert** inherently form a self-assembled monolayer which serves as a diffusion barrier for the reasons indicated above in reference to **Schnur**. Moreover, in “EXAMPLE 1” beginning in col. 12, the sentence bridging cols. 12 and 13 indicate that the “catalyst ligating group” (called now a

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“silane compound”) provided *monolayer* coverage of the substrate (a silica slide in this example). Because the silane compound is bonded to the surface by reacting only with available surface sites, it is by definition also *self-assembled*. Accordingly, even without the benefit of the **Schnur** reference, the diffusion barrier in **Calvert** is seen to be a self-assembled monolayer, covalently bonded to the surface of the substrate. Once the diffusion barrier is formed, it is treated with a catalyst and then electroplated (just as in **Schnur**) to form a metal layer on the diffusion barrier. (See **Calvert**, at least EXAMPLE 1 and EXAMPLE 20.)

Regarding claims 13, 15, 17, 19, 21, and 23, “EXAMPLE 1” col. 12, “EXAMPLE 20” col. 18, “EXAMPLE 21” col. 19, each use the silane compound β -trimethoxysilylethyl-2-pyridine which leads, by reaction with the substrate surface, to the diffusion barrier having the structures as instantly claimed --particularly claims 17 and 23, which are further limiting examples of the structures in claims 15 and 21, respectively-- as further discussed below.

First, the “ethyl” syllable refers to the $(CH_2)_2$ group, the silyl to the Si, and the pyridine to the six-atom cyclic aromatic group containing the nitrogen wherein R^3 and R^4 are hydrogen. The trimethoxysilyl refers to $(CH_3O)_3Si-$ group which, upon reaction produces the Si bonded to the 3 oxygen atoms which are, in turn, bonded near the surface of the substrate (as in instant claims 13 and 19). The “trimethoxy” portion of the compound is the counterpart to the “trichloro” portion in **Schnur**, above, which enables reaction with the substrate surface. (For verification that the trimethoxysilyl group inherently leads to the three Si-O bonds as instantly claimed, see the article **Simon et al.** “Synthesis and characterization of a new surface derivitizing reagent to promote the adhesion of polypyrrole films to n-type silicon photoanodes: N-(3-(trimethoxysilyl)

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propyl)pyrrole" Journal of the American Chemical Society, 104, Dec. 1982, pp. 2031-2034 -- especially see the second page, the left-hand column, and Fig. 1 in the right-hand column.)

Conclusion

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

US 5,077,085 (**Schnur** et al.), US 5,468,597 (**Calabrese** et al.), US 5,500,315 (**Calvert** et al.), US 5,510,216 (**Calabrese** et al.), US 5,648,201 (**Dulcey** et al.), US 6,348,240 B1 (**Calvert** et al.) each are related patents and share common inventors to the **Schnur** and **Calvert** references applied above and are believed to anticipate at least the independent claims, as presently claimed.

US 5,057,339 (**Ogawa**) in Fig. 1C anticipates at least instant claims 12, 13, 18, and 19.

US 5,939,150 (**Stelzle** et al.) anticipates at least instant claims 12 and 18.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Erik Kielin whose telephone number is 703-306-5980. The examiner can normally be reached on 9:00 - 19:30 on Monday through Thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached at 703-306-2417. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9318 for regular communications and 703-872-9319 for After Final communications.

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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.



Erik Kielin
July 18, 2002